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The onset of prebasic body moult during the breeding season in some high-Arctic waders

by P. N. Ferns

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Wading birds nesting in the Arctic have 4 alternative schedules of prebasic (postnuptial) moult. Some species undergo a relatively rapid moult at, or hear, the breeding grounds (Holmes 1966, Bengston 1975), while others embark on a more leisurely moult after migrating south (Soikkeli 1967, Holmes 1971, Nieboer 1972). Intermediate schedules also occur, in which prebasic moult is started near the breeding grounds, and is then either suspended or continued during the southerly migration (Holmes 1972, Pienkowski *et al.* 1976). During the 1974 Joint Biological Expedition to N.E. Greenland (25 June–31 August), 4 species of adult wading birds were captured during the late stages of incubation or after the hatching of their young. These birds were examined thoroughly for any traces of moult and information was also recorded on the refeathering of the incubation patches. In the absence of museum specimens showing moult of the remiges or retrices it had previously been assumed that all these species underwent the whole of the prebasic moult at, or en route to, the wintering quarters.

The species examined were *Charadrius h. hiaticula*, *Arenaria i. interpres*, *Calidris alba* and *Calidris alpina arctica*. They were captured between 25 June and 10 August in wire traps or small clap-nets, set over nests or young pulli, at 3 sites along the southwestern shores of Kong Oscars Fjord in N.E. Greenland (c 72°N). Most birds examined in detail were from Orsted Dal, the remainder coming from Mestersvig and Antarctics Havn. The extent of the moult in 4 regions of the body (coronal region of the capital tract, interscapular region of the dorsal tract, cervical and sternal regions of the ventral tract) was roughly quantified using a 5 point scale (all old=0, beginning of moult=10, middle of moult=20, end of moult=30, all new=40). This differs from the more complex scoring system used by Holmes (1966), but involves the same 4 regions of the body, and gives broadly comparable results. In most cases the date of hatching of the eggs of each adult was known, but otherwise an estimate was made using the methods described by Green *et al.* (1977).

Results

At Orsted Dal 4 out of 5 *Ch. hiaticula* and 6 out of 9 at Mestersvig showed some prebasic body moult (Fig. 1). The areas of the body involved were the throat, chest, breast, belly, flanks, crown, nape, mantle, back, rump, median and lesser upper wing-coverts, under tail-coverts and the innermost greater upper wing-covert, though not all in the same individual. The amount of body moult, when present, varied from a small amount on the crown, to the whole of the body plumage plus some wing-coverts. The overall average body moult score was 28, out of a possible maximum of 160. There was no significant difference between the moult scores of the sexes at either site, though in both cases the females had the higher scores. Overall, there was no significant correlation between moult score and date ($r=0\cdot23$, $p>0\cdot10$), or between moult score and the stage of the nesting cycle measured as days since hatching), although the latter approached significance ($r=0\cdot45$, $p=0\cdot05$–$0\cdot10$). There was a large difference between the average scores at Orsted Dal (48) and Mestersvig (17) and this was significant (Mann-Whitney

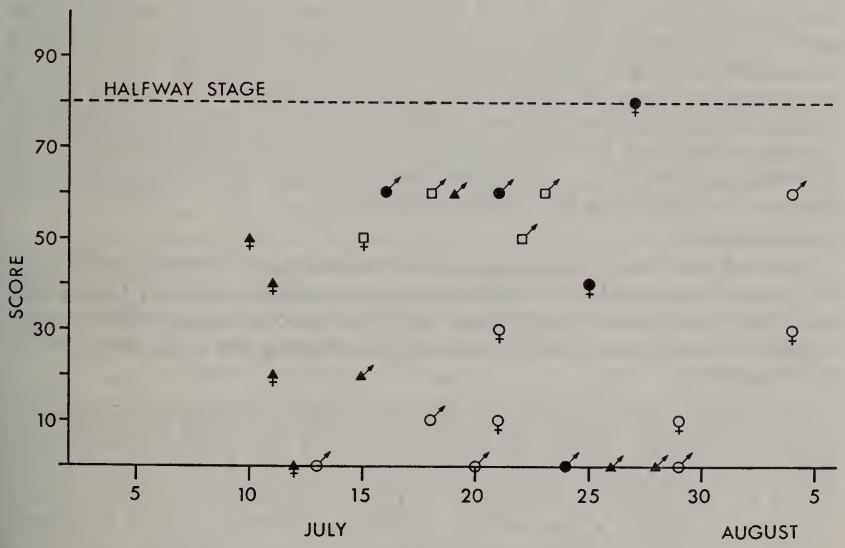

Fig. 1. Prebasic body moult scores of northeast Greenland waders in 1974. Open circles=*Charadrius hiaticula* at Mestersvig; closed circles=*Ch. hiaticula* at Orsted Dal; closed triangles=*Calidris alba* at all sites; open squares=*Arenaria interpres* at Orsted Dal. The sex of each bird is also indicated. For method of scoring see text.

U-test, $p=0\cdot01$ to $0\cdot05$). Most of this difference was no doubt due to the large disparity in the timing of breeding between the 2 sites—*Ch. hiaticula* at Mestersvig nesting on average 10 days later than at Orsted Dal (Green *et al.* 1977). The individual with the highest body moult score was a female at Orsted Dal accompanying a half grown chick on 27 July. The earliest date on which prebasic moult was recorded was 16 July and the earliest time in relation to the breeding cycle was 7 days before hatching. Two individuals,

neither of them undergoing body moult, were replacing respectively one and 3 tail feathers asymmetrically, presumably as a result of traumatic losses.

Arenaria interpres.

Of 8 *A. interpres* all of which were captured at Orsted Dal, 5 showed some prebasic body moult, ranging from a small amount on the undersides to an extensive moult of the spinal and ventral tracts. No moult was recorded on the head. The average moult score in these 8 birds was 24. This sample is too small for statistical analysis, but moult was more advanced in females (mean score 28) than in males (mean score 20), even though the latter were caught on average 11 days later in the nesting cycle. Moult scores of 40 and 50 were observed as early as 7 and 10 days before hatching, and the earliest date on which a moulting bird was caught was 10 July. There was a strong positive correlation between weight and moult score in this species ($r=0{\cdot}84$, $p=0{\cdot}001$ to $0{\cdot}010$), perhaps because heavier birds were in better condition and were therefore able to undertake a more extensive moult.

Calidris alba.

All 4 of the *C. alba* examined in detail showed extensive prebasic body moult. The average score was 55 and the earliest date on which moulting was observed was 15 July (about 5 days before hatching). In 2 of the 3 males examined, the rich brown feathers of the chest, which extend further ventrally than in females, had been almost completely replaced by the whitish feathers of the basic (winter) plumage. This probably explains why it became increasingly difficult to recognise males amongst the many adult birds observed in the field as the season progressed.

Calidris alpina.

None of the 11 *C. alpina* captured showed any trace of prebasic moult, but they were all captured close to the date when their eggs hatched. This species undergoes the whole of the prebasic moult on the breeding grounds in some regions (Holmes 1971), so it is particularly surprising that none was recorded in Greenland.

In all adults captured whilst attending pulli, refeathering of their incubation patches had begun around the edges, and it had also started in some birds which were still incubating. The earliest example of refeathering was a female *C. alba* captured on eggs on 12 July, 5 days before hatching. A male *C. alpina* caught in a mist net on 10 August amongst a flock consisting predominantly of juveniles, had pin feathers covering the entire area of the incubation patches. Despite the early onset of brood patch refeathering, these waders continued to brood their young from time to time, especially during inclement weather, for 2 weeks or so after hatching. Refeathering of the incubation patches before hatching has also been reported in *Anous minimus* (Jones 1971) and *Diomedea immutabilis* (Fisher 1971).

Discussion

Over 70% of individuals other than *C. alpina* had started prebasic body moult. Furthermore, this moult was quantitatively significant in view of the fact that the body feathers constitute about 80% of the total feather mass in waders (Holmes 1966). In *A. interpres*, the average moult score (including those individuals not in moult) indicates that at least 12% of the total feather

mass was being replaced on the breeding grounds. The equivalent figures were 14% for *Ch. hiaticula* and 28% for *C. alba*. Since *C. alba* nests earliest in this region, followed by *A. interpres*, *Ch. hiaticula* and *C. alpina* (Green *et al.* 1977) the extent of the prebasic moult appears to be related to the average timing of the breeding season in these species. The difference in moult between *Ch. hiaticula* at Orsted Dal and Mestersvig tends to confirm this.

The early onset of prebasic body moult amongst species which undergo the major part of their moult elsewhere has been recorded at several other sites in the Arctic, though it has seldom been quantified. Parmelee & MacDonald (1960) found traces of moult in small numbers of *A. interpres*, *C. canutus* and *C. alba* on Ellesmere Island (c 80° N). Parmelee *et al.* (1967) found traces of moult in *Ch. semipalmatus*, *A. interpres*, *C. melanotus* and *Phalaropus fulicarius*, together with extensive body moult in *Tryngites subruficollis*, on Victoria Island (c 69° N). *C. bairdii* had also started prebasic body moult at both of the above locations and on Baffin Island (c 69° N) (Wynne-Edwards 1952). Kistchinski (1975) recorded both prealternate (nuptial) and prebasic body moult in *P. fulicarius* on the breeding grounds in Siberia (c 70° N). *C. ruficollis* and *C. ferruginea* arrive at wintering quarters in Tasmania with arrested prebasic body moult showing that at least part of the moult occurs elsewhere, perhaps on the breeding grounds (Thomas & Dartnall 1971a, b). 47% of individuals of *C. mauri* in subarctic Alaska began prebasic body moult on the breeding grounds in June and reached an average score of 6 (maximum 40) before suspending for the southward migration, though adults associated with nests or young did not moult (Holmes 1972).

In view of the wide range of species and geographical areas from which this type of moult has been reported, it may be of greater importance than previously suspected. It presumably allows birds to take advantage of favourable feeding conditions towards the end of the breeding season and thereby reduces the amount of time spent at moulting areas further south. One curious feature of the prebasic body moult is that it starts in different parts of the body in different species. For example, in *C. mauri* the head is one of the first areas to start (Holmes 1972), whereas in *C. maritima* it is one of the last (Morrison 1976). In Greenland, the moult of the neck was particularly heavy in the early stages in both *Ch. hiaticula* and *A. interpres*, whilst the moult of the breast started early in *C. alba*. It may be significant that moult in these particular areas of the body tends to reduce the conspicuousness of the nuptial plumage.

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Undescribed *Acrocephalus* Warblers from Pacific Ocean Islands

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During studies of Polynesian birds we have located old museum specimens of *Acrocephalus* spp. from Pacific Ocean islands that apparently represent 2 undescribed forms. Another form, known only from old descriptions, has been widely overlooked. All 3 populations are now almost certainly extinct, so it seems worthwhile to draw attention to them and give names to the undescribed forms since additional information is unlikely to become available.

Acrocephalus caffer garretti subsp. nov.

Description. Two apparently adult specimens are closely similar in coloration to *Acrocephalus caffer caffer* (Sparrman) from Tahiti (described in detail by Murphy & Mathews 1928), although the pale cream fringes to the feathers of the upperparts of the body may be slightly broader, especially on the rump and uppertail-coverts. However, they are substantially larger than *A. c. caffer*, especially the wing- and tail-length (Table 1). They differ from the large *A. c. longirostris* (Gmelin) of Moorea (described by Murphy & Mathews 1928), which has all but the central pair of retrices mainly pale cream, in having all the rectrices blackish-brown with narrow pale cream tips that are somewhat broader on the outermost feathers. They differ from Marquesas Islands populations in having much paler yellow underparts and other